

WHAT IS CLAIMED IS:

1. A method of transmitting digital data by wireless so as to permit a reception in a reduced bit error rate in a digital wireless communications system, the method including the steps of:

5        converting said digital data into a first stream of information signals through a more-than-7-signal-point modulation scheme;

         inserting a pilot signal regularly in said first stream of said information signals into a second stream of said information signals and said pilot signal, an amplitude of said pilot signal being larger than that of any of  
10        said information signals; and

         transmitting said second stream by wireless.

2. A method as defined in claim 1, wherein said step of inserting a pilot signal includes the step of setting said amplitude of said pilot signal not  
15        larger than 1.6 times a maximum possible amplitude of said information signals.

3. A method as defined in claim 1, further including the step of the transmitter limiting a frequency band of each information signal with a roll-off filter with a roll-off coefficient ranging from 0.1 to 0.4.  
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4. A method as defined in claim 1, wherein said more-than-7-signal-point modulation scheme is a 16-amplitude phase shift keying.

25        5. A method as defined in claim 4, wherein said step of inserting a pilot signal includes the step of generating said pilot signal so as to make an angle of  $\pi/8$  with adjacent information signals in an in-phase and

quadrature-phase signal space.

6. A method as defined in claim 1, wherein said more-than-7-signal-point modulation scheme is a  $2^m$ -signal-point quadrature amplitude modulation, where  $m$  is a positive integer not smaller than 3.

7. A method as defined in claim 6, wherein said step of inserting a pilot signal includes the step of generating said pilot signal so as to be disposed on one of an in-phase axis and a quadrature-phase axis in a signal space of said  $2^m$ -signal point quadrature amplitude modulation.

8. A method as defined in claim 1, wherein said more-than-7-signal-point modulation scheme is an 8 phase shift keying.

9. A method as defined in claim 8, wherein said step of inserting a pilot signal includes the step of generating said pilot signal so as to make an angle of  $\pi/8$  with adjacent information signals in an in-phase and quadrature-phase signal space of said 8 phase shift keying.

10. A method of transmitting digital data by wireless so as to permit a reception in a reduced bit error rate, the method including the steps of:

converting said digital data into a first stream of information signals through a quadrature phase shift keying modulation;

inserting a pilot signal regularly in said first stream of said information signals into a second stream of said information signals and said pilot signal, an amplitude of said pilot signal being larger than that of any of said information signals; and

transmitting said second stream by wireless.

11. A method as defined in claim 10, wherein said pilot signal is so disposed as to make an angle of  $\pi/4$  with adjacent information signals in an in-phase and quadrature-phase signal space of said quadrature phase shift keying modulation.

12. A method as defined in claim 10, wherein said step of inserting a pilot signal includes the step of setting said amplitude of said pilot signal not larger than 1.6 times a maximum possible amplitude of said information signals.

13. A method as defined in claim 10, further including the step of limiting a frequency band of each information signal with a roll-off filter with a roll-off coefficient ranging from 0.1 to 0.4.

14. A system capable of transmitting digital data by wireless so as to permit a reception in a reduced bit error rate, the system including:

means for converting said digital data into a first stream of information signals through a more-than-7-signal-point modulation scheme; means for inserting a pilot signal regularly in said first stream of said information signals into a second stream of said information signals and said pilot signal, an amplitude of said pilot signal being larger than that of any of said information signals; and

means for transmitting said second stream by wireless.

15. A system as defined in claim 14, wherein said inserting means

includes means setting said amplitude of said pilot signal not larger than 1.6 times a maximum possible amplitude of said information signals.

16. A system as defined in claim 14, further including means for  
5 limiting a frequency band of each information signal with a roll-off filter with a roll-off coefficient ranging from 0.1 to 0.4.

17. A system as defined in claim 14, wherein said more-than-7-  
signal-point modulation scheme is a 16-amplitude phase shift keying.  
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18. A system as defined in claim 17, wherein said pilot signal is so disposed as to make an angle of  $\pi/8$  with adjacent information signals in an in-phase and quadrature-phase signal space.

15 19. A system as defined in claim 14, wherein said more-than-7-signal-point modulation scheme is a  $2^m$ -signal-point quadrature amplitude modulation, where m is a positive integer not smaller than 3.

20. A system as defined in claim 19, wherein said pilot signal is  
20 disposed on one of an in-phase axis and a quadrature-phase axis in a signal space of said  $2^m$ -signal point quadrature amplitude modulation.

21. A system as defined in claim 14, wherein said more-than-7-signal-point modulation scheme is an 8 phase shift keying.

25 22. A system as defined in claim 21, wherein said pilot signal is so disposed as to make an angle of  $\pi/8$  with adjacent information signals in an

in-phase and quadrature-phase signal space of said 8 phase shift keying.

23. A system capable of transmitting digital data by wireless so as to permit a reception in a reduced bit error rate, the system including:

- 5        means for converting said digital data into a first stream of information signals through a quadrature phase shift keying modulation;
- means for inserting a pilot signal regularly in said first stream of said information signals into a second stream of said information signals and said pilot signal, an amplitude of said pilot signal being larger than that of any of
- 10      said information signals; and
- means for transmitting said second stream by wireless.

24. A system as defined in claim 23, wherein said pilot signal is so disposed as to make an angle of  $\pi/4$  with adjacent information signals in an

15      in-phase and quadrature-phase signal space of said quadrature phase shift keying modulation.

25. A system as defined in claim 23, wherein said inserting means includes means setting said amplitude of said pilot signal not larger than 1.6

20      times a maximum possible amplitude of said information signals.

26. A system as defined in claim 23, further including means for limiting a frequency band of each information signal with a roll-off filter with a roll-off coefficient ranging from 0.1 to 0.4.

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27. A mobile telephone that communicates digital data with a reduced bit error rate, the mobile telephone comprising:

a transmission system; and

a receiver system, said transmission system including:

means for converting said digital data into a first stream of  
information signals through a more-than-7-signal-point modulation scheme;

5        means for inserting a pilot signal regularly in said first stream of said  
information signals into a second stream of said information signals and said  
pilot signal, an amplitude of said pilot signal being larger than that of any of  
said information signals; and

means for transmitting said second stream.

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28. A mobile telephone as defined in claim 27, wherein said inserting  
means includes means setting said amplitude of said pilot signal not larger  
than 1.6 times a maximum possible amplitude of said information signals.

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29. A mobile telephone as defined in claim 27, further including  
means for limiting a frequency band of each information signal with a roll-off  
filter with a roll-off coefficient ranging from 0.1 to 0.4.